The Cost-effective Application of Solar Energy

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Abstract

Solar power is an environmental protection, clean energy. Solar power system consists of solar panels, converter, battery and inverter. The main ingredient of solar panels is Silicon. Si is one of the most abundance of material on our planet. The solar power system in this research includes three 15-watt solar panels, a 12VDC converter, battery and a 1000-watt inverter. The energy is collected through the solar panels and stored in the battery. The inverter is used to convert 12VDC into 120VAC, which can provide a variety of experiments and applications. The purpose of this study is to find a system we can apply the solar power to our daily use cost-effectively.

Solar Electric Conversion Process

Step 1:

Place solar panels in the sun, then using the converter to collect the energy for the following steps.

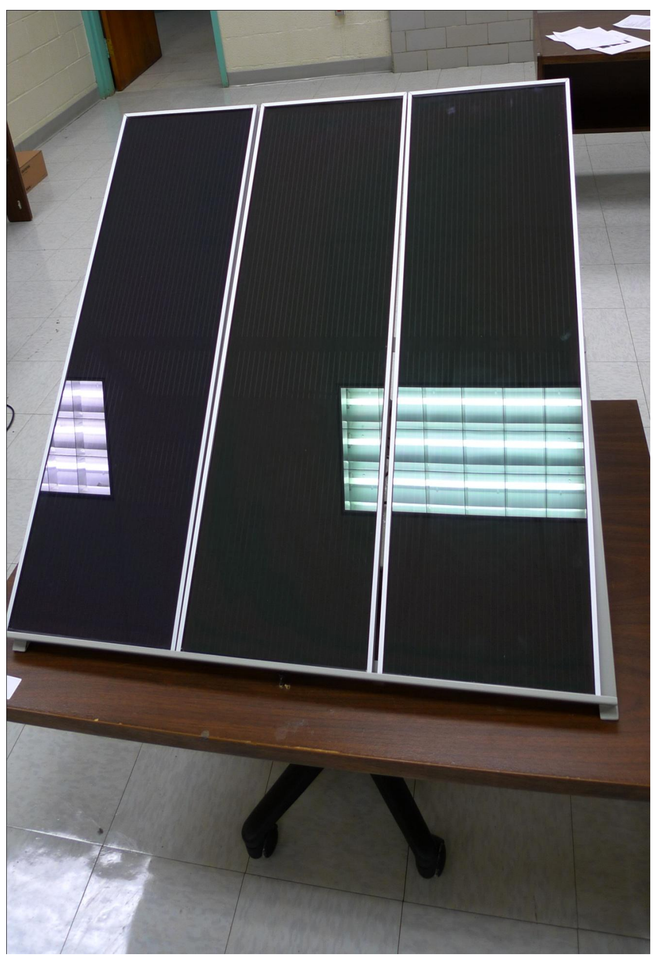

Figure 1. 45-Watts Amorphous Solar Panels

Figure 2. inverter

After data collection, the open circuit voltage is 14V(13.9V~14.1V). By the solar meter, the irradiation is about 1100 (watts/m^2)

Step 2:

The energy from the converter can lighten a 5W/12VDC bulb.

Figure 3. 5W 12VDC Bulb

Step 3:

Through the inverter, the 12VDC can be converted to 120VAC for our daily use.

Figure 4. 12VDC-120VAC Inverter

Data Analysis and Simulation

1. Connect the Bulb

The output voltage of the converter can lighten the bulb. At this time , the power of the bulb is 5W, the voltage is 14V and the current is 0.36A.

2. Connect to inverter

By connecting a load, the max current of converter is 2.4A. We can get steady 120VAC.

3. Simulation (SCAPS)

By the software SCAPS, the result of the simulation is higher than the actual value due to the temperature, sunshine intensity and solar conversion efficiency. The coefficient is 14V*2.4A/45W = 0.75

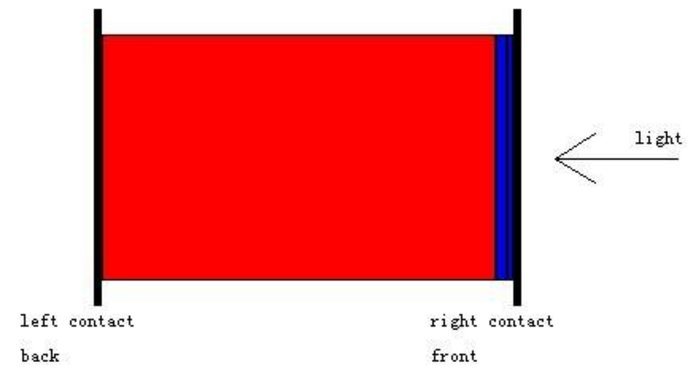

Figure 5. The Module of Single Solar Panel

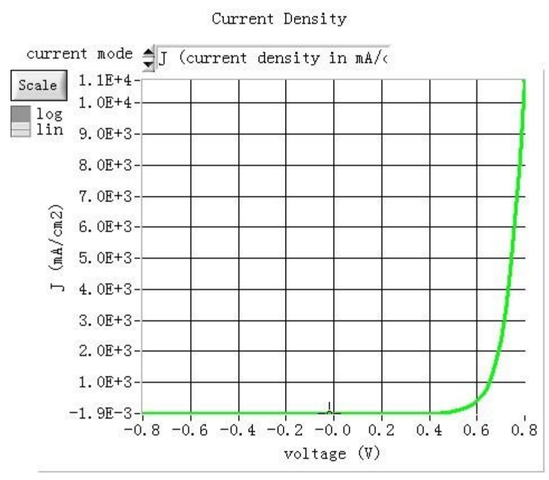

Figure 6. The Result of The Simulation

Results

After testing, this solar power system can charge a 12V battery in the daytime, which will provide two 60W lamps and a 80W television for 4 hours of electricity, while it also can charge a mobile phone through the USB.

CONCLUSION

This solar power system can be fully applied to the real life. It can replace part of the daily power consumption and also provide an emergency power supply. Moreover, considering the cost factor, it will be a cost-effective sustainable energy system.